



# **Hydrogen Use to Enable Renewable Energy Technologies**

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The National Hydrogen Association

DER Road Show



# Background: The NHA

- Over 90 Members
- Strong, Diverse Membership
  - Energy companies, industrial gas suppliers, utilities, automotive manufacturers, transit agencies, fuel cell developers, many others
  - International and Multinational Companies
- Dedicated to removing barriers and building markets for hydrogen-related energy systems

[www.HydrogenUS.org](http://www.HydrogenUS.org)



# Hydrogen Basics

- Properties
  - Hydrogen is the lightest, most basic, abundant element
  - Properties are unique - must be treated appropriately
- Production
  - Today, mainly through reformation of fossil fuels
  - Future, from renewables as well as fossil fuels with carbon sequestration
- Uses, Today and Future
  - Today: chemical processing, petroleum industry, fats and oils, metals, electronics, space flight, utilities, glass manufacturing, and others
  - Future: stationary power, portable power, and transportation.

# Why Hydrogen



- Environment
  - No carbon, no emissions at all when used in a fuel cell
- Energy Diversity
  - Can be produced from any energy resource
  - Vision is renewable energy produced hydrogen
- Transforming Energy Carrier
  - Wind can become a transportation fuel
  - Another way to make solar an off peak electric resource
  - Clean, highly efficient at small scale with fuel cells
- Energy Security
  - Local resources can be substituted for imported fuels

# Applications



- Stationary Power
  - Uninterruptible power supply
  - Remote villages
  - Clean customer power
- Portable Power
  - Fuel cells with Hydride storage replacing batteries
- Transportation
  - Buses
  - Fleet vehicles
  - Cars

# Markets and Growth



- National energy security
- Global markets for vehicles, aircraft, and electricity are estimated to grow by a factor of 10 over the next century
- 40% of the human race has no access to electricity
- Disruptions in electricity supply are growing
- Environmental concerns driving new technologies
- Business case can be made

# U.S. Trends



- National Energy Security
- Climate Change
- Public interest in renewable energy
- Distributed generation
- Zero or ultra-low emission vehicles to improve urban air quality

# Renewable Production



- Biomass
- Photovoltaics
- Wind
- Tidal
- Hydroelectric





# Synergistic Enablers

- Hydrogen enables wider-scale use of renewables
- Renewables enable pollution-free vision of the hydrogen economy



# Benefits

- Energy Diversity
- Environmentally benign
- Broader, higher-value market for renewables
  - Transportation, portable applications
- Solves intermittent power issues
- Load management
  - Produce H<sub>2</sub> during peak supply for use during peak demand
- Economic advantage for renewables
  - Allows market for “over-capacity”



# Government Roles

- Cost-shared R&D
- Demonstrations
  - Test viability
  - Develop infrastructure
  - Develop public familiarity and acceptance
- Codes and Standards
- Education
- Incentives
- Federal government as early market



# Outlook

- Unprecedented Industry Interest
  - BP, ChevronTexaco, Shell...
  - BMW, Ford, GM, DaimlerChrysler...
  - Diversity of commercial paths
  - Viewed as important new market
- Unprecedented Government Interest
  - Increased technology development funding
  - new FreedomCAR H<sub>2</sub> and FC initiative
  - Tax incentives being considered



# Conclusion

- Competitive business strategies and competitive technologies provide robust setting
- Hydrogen vision
  - Hydrogen enables renewable energy use in mainstream of transportation
  - Obtain firm and usable power from intermittent renewable energy resources
- No environmental impact at point of use

[Hydrogen... The Freedom Fuel<sup>SM</sup>](#)



# For More Information

- NHA Membership
  - Industry, Power providers, Research Organizations, Government agencies, National/International, University, Student/Teacher
- 15th Annual U.S. Hydrogen Conference and Exposition
  - April 26-30, 2004 Hollywood, California
- Hydrogen Safety, Codes & Standards
- NHA Policy

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